FACTORS AFFECTING PREVALENCE OF OVERWEIGHT AND OBESITY IN URBAN ADOLESCENTS

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Certificate

This is to certify that the dissertation entitled "**FACTORS AFFECTING PREVALANCE OF OVERWEIGHT AND OBESITY IN URBAN ADOLESCENTS"** is the bonafide original work of **Dr. E. HARI KRISHNAN**, in partial fulfillment of the requirements for **M.D.BRANCH- VII (PAEDIATRICS)** Examination of The Tamil Nadu Dr. M.G.R. Medical University to be held in March 2009.

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DECLARATION

I, **DR. E. HARI KRISHNAN**, solemnly declare that dissertation titled, "**FACTORS AFFECTING PREVALANCE OF OVERWEIGHT AND OBESITY IN URBAN ADOLESCENTS"** is a bonafide work done by me at Institute of Social Pediatrics, Govt. Stanley Medical College & Hospital,Chennai-1 during the period of October 2007 to October 2008 under the guidance and supervision of our **Prof. DR. M. L. VASANTHAKUMARI, M.D, D.C.H,** Director, Institute of Social Pediatrics, Govt. Stanley Medical College & Hospital, Chennai–600 001.

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CONTENTS

INTRODUCTION

Obesity is a challenging multifactorial problem. It is escalating at an alarming rate across the globe in all age groups, especially among the urban population. Various studies have shown that there is up to 5 – 10 % increase in obesity per decade in the latter quarter of the last century. There is a striking increase in 50% of obese children from 1973 – 1991.(1)

Obesity in childhood is an important risk factor for obesity in adulthood and up to 80% of them become obese adults.(2) This phenomenon of tracking warrants prevention and early intervention.

There is a paradox of under nutrition and obesity co-existing in the developing countries like India. In India, under nutrition attracted the focus of health workers, as childhood obesity was rarely seen. Childhood obesity is increasingly being observed with changing lifestyles of families with increased purchasing power, increasing hour of inactivity due to television, video games and computers have replaced outdoor games and other social activities(3). It is attributable to urbanization, technology based sedentary life style, high fat high sugar junk food, increasing purchasing power, lack of exercise, excessive TV viewing and video games usage.

Obesity can be seen as the first wave of a defined cluster of non-communicable diseases called NEW WORLD SYNDROME creating an enormous socioeconomic and public health burden in poorer countries(4). The

World Health Organization has described obesity as one of today's most neglected public health problems. Following the increase in adult obesity, the proportions of children and adolescents who are overweight and obese have also been increasing (5). There are innumerous health hazards that are linked to obesity like coronary artery disease, cerebrovascular diseases, hypertension etc. the most significant long term consequences of childhood and adolescent overweight and obesity are their persistence into adulthood with all of the attended health risk.(6-10)

Several cross sectional studies in western countries have shown that overweight and obese adolescents are less physically active than non – obese subjects and physically inactivity, high social economic back ground and dietary transitition were found to be major factors. However, in this study, role of factors such as participation in sports and games, household chores, physical inactivity such as television viewing and playing computer/ video games and consumption of junk food were also studied. Therefore this study was undertaken to estimate the overall prevalence of overweight and obesity among adolescents of zone II north Chennai, Tamilnadu in south India and to examine its associated factors

REVIEW OF LITERATURE

Ten percent of children, or at least 155 million youngsters worldwide, are overweight or obese (11).What was once a health problem for the Industrialized world with its high calorie foods, labor-saving devices and dwindling levels of physical activity has now spread to developing Countries. Countries like Thailand, Iran, Nigeria and Brazil have all reported unprecedented levels of obesity with substantially rising trends every year.

In South Africa, about 25 percent of girls from 13-19are overweight or obese(12). The epidemic of obesity, sits alongside the problem of under nutrition and infections in India thereby creating a greater burden of nutrition-related ill health among our children. The problem of childhood obesity is now sweeping our nation. Studies among school children indifferent parts of the country have demonstrated increasing prevalence of overweight and obesity, with great disparity between rural and urban parts of country. The prevalence of overweight was 37.5% in urban Delhi and 8% in rural Haryana (13). The prevalence of overweight and obesity is higher in upper socioeconomic class (17.2% overweight and4.8% obese) as compared to lower socioeconomic class (4% and <1%, respectively). Although the prevalence of obesity may not be as high as in the West but the body composition and metabolism of Indians

(Asians), with a 3 to 5% higher body fat and central location of body fat for the same BMI makes them more prone to its ill effect(14).

OBESITY:

Obesity is a state of excess adipose tissue mass. Although not a direct measure of adiposity, the most widely used method to gauge the obesity is the body mass index, which is equal to weight(kg)/height(m)^2

Obesity is defined as body mass index of more than 95th percentile specific for the age and gender

Overweight is defined as body mass index more than 85th percentile specific for age and gender. Those people with BMI between the 85th and 95th percentiles are overweight and are at increased risk for obesity related co-morbbidities.in adults BMI more than 30 is obese.

The body mass index is a statistical measurement which measures a person's weight and height. Though it is not actually measure the percentage of body fat but a useful tool to estimate the healthy body weight based on how tall a person is. It is invented between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing social physics.(15) The body mass index is defined as the individuals body weight in kilograms divided by the square of their height in centimeters.

$$BMI = WEIGHT\ (Kg) / HEIGHT^{2}\ (m^2)$$

Biochemical changes in obesity:

Components of energy balance:

Energy intake:

The calorie or energy content of the food varies from 4 kcal per gram for carbohydrates to 9 kcal per gram for fat.

Energy expenditure

It is determined by resting metabolic rate , meal induced thermo genesis and physical activity.

- **Resting metabolic rate**:

  It is the energy expended by the body to maintain normal physiologic functions. Resting metabolic rate occurs predominantly in muscles and other major organs. The resting metabolic rate for adolescence is 28 kcal / kg.

- **Meal induced thermo genesis**:

  It occurs over an extended period for at least five hours. The cumulative energy cost is equivalent to approximately ten percent of energy utilized. The thermogenic effect is higher for proteins (30%) and carbohydrates (15%) than for fat. This is because the process of energy storage is efficient for fat whereas additional energy is required to convert carbohydrate and proteins to its appropriate storage form.

- **Physical activity**:

The energy expenditure in physical activity is determined by the amount or duration of activity, type of activity and the intensity with which the activity is performed. The metabolic count of physical activity is expressed as metabolic equivalents or METS which represents multiples of resting metabolic rate. Sitting quietly after one hour fast is equivalent of one MET. The physical activity provides the greatest source of flexibility in the energy expenditure system and larger changes of energy expenditure can be achieved by physical activity.

Activity	Energy Expended Per Hour In Kcal	Food Equivalent Expended Per Hour
Driving a car	80	Slice of bread
Standing relaxed	100	Glass of white wine
Standing doing light work	180	Bag of crisps
Walking five km per hour	260	One and half pints of beer
Walking seven km per hour	420	Two and half ounce peanuts
Running nine km per hour	600	Two chocolate bars

Energy storage:

When energy intake exceeds energy expenditure a state of positive energy balance occurs. An overfeeding relative to energy needs occurs; the body increases its overall energy source.

Epidemiology:

Obesity is a challenging public health problem and tracking of weight, height and BMI using simple charts. The factors that affect growth and development are interlinked and faced by several confounding and modifying factors. The essence is that provide a nurturing environment during intra uterine and post natal life or rather starting from childhood and adolescent life of prospective mothers may act as a real preventive strategy against most adult onset diseases. At the same time it is important to tackle and control confounders, modifiers and amplifiers like feeding practices nutritional status and life style. it is better to pave the way for positive health, which is the motto of the era, rather than prevention.

1. Age:

Obesity can occur at any age and generally increases with age. Infants with increased weight have increased incidence of obesity in later life.(16) About one third of adulthood was obese from childhood.(17)

2. Sex:

Women generally have higher rate of obesity than men, although men have higher rate of overweight.

3. Physical Inactivity:

There is convincing evidence that regular physical activity is protective against unhealthy weight gain. Whereas sedentary life style particularly sedentary occupation, an inactive recreation such as watching television, video

games and computers which have replaced outdoor games. High burden of school work and academic competitiveness have led to decreased participation in sports and other forms of physical activity. This is particularly true for girls who are sedentary from school years. The lack of appropriate play area and limited open space around home makes it difficult for children to stay physically active.

4. Socioeconomic Status:

The direct relation to obesity to higher socioeconomic group is due to increased purchasing power, increased use of vehicular transport, sedentary life style. Parents are often over worked and find it easy to let children order fast foods and hardly have any time to oversee balanced nutrition for children.

5. Eating Habits:

The composition of diet, the periodicity with which eaten and energy derived from it are all relevant to the etiology of obesity. A diet containing more energy than needed may lead to prolonged post prandial Hyperlipidaemia and to deposition of triglycerides in adipose tissue leading to obesity. Eating habits established early in life are very difficult to change. It has been calculated that a child whose energy requirement is 2000 kilo calorie per day and who consumes 100 kilo calories per day extra will gain about 5 kilogram per year(18). More than 84% of children and adolescents eat too much total fat. 91% eat too much saturated fat (i.e., more than 10% of calories from saturated fat). On average, young

people get 33%—34% of their calories from total fat and 12%—13% of their calories from saturated fat. Children and adolescents eat, on average, only 3.6 servings of fruits and vegetables a day, and fried potatoes account for a large proportion of the vegetables eaten. Fifty-one percent of children and adolescents eat less than one serving of fruit a day, and 29% eat less than one serving a day of vegetables that are not fried.

6. Socio Cultural Issues :

There is general misconception in india that an obese child is a healthy child and when a child is fat , the baby fat will go away with time. In an effort to keep child healthy he or she is fed in excess and many of children remain obese for life.

ADOLESCENCE:

The now familiar term adolescence meaning to grow up was popularized less than hundred years ago. This is the period when child is transformed into an adult man or woman. It extends from onset of puberty till the time when sexual maturation is completed and encompasses physical, emotional, cognitive, social growth and developmental aspects bridging childhood and adulthood. Hormones, in conjunction with social structures designed to foster this transition, bringing about the change.

Depending on the purpose for which they are made, definitions vary as to the exact age range of adolescence and the physiological and

psychological events that characterize it. In general WHO has defined it as a period from 10 to 19 years of age. It has further been divided into three phases as:

- Early adolescence – 10 to 13 years
- Middle adolescence – 14 to 16 years
- Late adolescence – 17 to 19 years.

The term puberty is used to describe different phases of sexual maturation between childhood and adulthood, i.e. the time when procreation becomes possible. The term refers collectively to the morphological, physiological and psychological changes occurring in the growing boys and girls, as the gonads change from the infantile to the adult state. These changes involve nearly all organs and structures of the body. They do not begin at the same age or take the same length of time to reach completion in all individuals. It is the phase of development between the first appearance of gonadotropin mediated secondary sex changes (breast budding in girls and testicular enlargement in boys) and the attainment of fertility.

FOOD HABITS:

The last two decades have witnessed tremendous changes in the food habits of Indian population, especially in urban and semi – urban areas. Just as there is changing in the trends of dietary pattern in general public, similar patterns are seen in children. The growing

independence, increased participation in social life and generally busy schedule of adolescents influence their eating habits. Meal patterns of adolescents are of chaotic, teenagers skip more meals at home as they get older, often skipping breakfast and lunch altogether. Females tend to miss more meals than males. Snacking is also very common. Fast foods appeal most to teenagers as it is inexpensive, well accepted and can be eaten informally without the use of utensils or plates. Increased availability of fast foods result in increased volume of foods obtained away from home, which may adversely affect the nutritional quality of the diet. There is also decreased intake of whole milk and eggs, greater use of low fat and non - fat milk, more snacking and eating away from home among children and adolescents. Any negative impact of fast foods on the diet of adolescents depends on how frequently they are eaten and the choices made.

Factors influencing food intake in adolescence:

Food intake habits are determined by numerous factors. Major influences for children include the family, peers, media and body image.

1. **Family**:

   Food habits and food likes and dislikes are formed in the early years and often continue into adulthood. Parents and siblings are the primary models for the young children to initiate the behavior. As children move into adolescents, they eat fewer meals

at home. With more women employed outside the home there may be less time available for food preparation and more use of fast food, eating out and preparing food themselves.

2. **Media**:

Television is the primary media influence on children of all ages. One half of all commercials are for food, with even higher percentage found in children's programs. The food items generally advertised to young audiences are sweetened cereals, fast food, snack foods and candy foods high in sugar, fat and salt. The commercial messages are not based on nutrition but on am emotional/ psychological appeal, i.e., fun, give you energy, yummy taste.

Television viewing has been suggested as a factor in the rising rate of obesity among children and teen agers. In addition to encouraging inactivity, there is the steady presentation of food and eating cues.

3. **Peers**:

As children move into the world, their food choices are influenced by others. During school years, friends rather than the menu decide participation in the school lunch program. Peer influence is particularly strong in adolescence as teenagers strive more independence and eating becomes a more social activity outside the home.

4. **Body image**:

Puberty is the period of greatest awareness of body image. It is normal for teens to be uncomfortable and dissatisfied with their changing bodies. The media, and popular idols offer a standard that adolescents compare themselves with, no matter how realistic it any be. To change their body image they may try restrictive diets, purchase weight loss products or in case of males, try supplements or diets in the hope of increasing their muscles. Some of these dietary measures may put them at risk for poor nutritional status.

Adolescents eating practices:

- Eating away from home
- Skipping meals
- Snacking
  - Over 90% eat snacks
  - Fast foods: high in fat, sugar and sodium
  - Up to one third of daily energy intake
- Breakfast is the most common meal missed by adolescents
- Consumption of imbalance between high energy low nutrient and low energy high nutrient food
- Interpretation of diverse feelings of situation as a reason to eat
- Susceptibility to eating cues unrelated to physiological needs
- Guilt related to eating under any circumstance.

Co morbidity:

People with BMI of 25 or above have an increased risk of developing co morbidities, which is further increased with BMI values more than 30.virtually all obese people will have developed physical symptoms by 40 years of age and the majority will require intervention for diseases that develop as a direct result of their obesity by the age of 60 years. For BMI values 40 or more, the risk of a life threatening disease developing as a direct result of obesity is extremely high.

Obesity not only causes much psychological morbidity, but is also a primary risk factor for the development of hypertension, cardio vascular disease, stroke, diabetes mellitus, hyperlipidemia, osteoarthritis, and cancer of the breast, ovary, prostrate and colon.

Obesity is associated with a considerably increased risk of endometrial carcinoma(the relative risk is 5.4 for those weighing 40% or more than average), and a greater risk of breast cancer in premenopausal women, and to some extent of bowel cancer in men.

Disease	Proportion (%)
Obesity	100
Hypertension	24.1
Myocardial infarction	13.9
Angina pectoris	20.5
Stroke	25.8
Venous thrombosis	7.7
Type 2 diabetes	24.1
Hyperlipidaemia	7.7
Gout	20.0

Osteoarthritis	11.8
Gall bladder disease	14.8
Colorectal cancer	4.7
Breast cancer	3.2
Genitourinary cancer	9.1

Obesity leads to premature mortality. A man weighing more than 140% of the average weight is 5.2 times more likely to die of diabetes than a man of ideal weight. Similarly a woman has 7.9 times higher risk.

People who are obese are more likely to develop gall stones because of their higher output of cholesterol in bile.

Osteoarthritis is a common complication of obesity, especially in weight bearing joints such as knees and hips. The risk of osteoarthritis is related to the total amount of fat rather than the extent of abdominal fat.

Obesity is associated with reproductive and menstrual disorders. Sleep apnoea is caused by the physical pressure effects of fat on the chest wall and upward pushing of liver, which compresses the lungs and leads to poor lung ventilation.

Management

1. Diet

Formal calorie-counting diets may be useful for getting someone who is obese or overweight started on a weight loss programme, but strict diets are difficult to sustain in a longer time. Most people like variety and enjoy treats. One of the most important aims in the programme is to help the patients to recognize danger foods particularly those high in fat, and help them to increase their own control over eating.

Calorie counting and fat avoidance can be encouraged by asking the patient to keep a food diary which can also provide insight when weight loss in not proceeding as planned. It is common in obese persons to underestimate their food intake by about one – third perhaps because of genuine forgetfulness or self – deception due to lack of understanding of food composition, particularly with regard to hidden fat. In particular, the eating of snacks is under reported.

The diet used should not prevent the patient enjoying normal social intercourse. Negative dieting is often counterproductive in the long term.

The approach should emphasize new food opportunities, new methods of food preparation and the integration of treats into the overall food plan.

The weight control programme is not just a one-off diet to give some rapid period of weight loss, but rather it is a process of re-education which will affect their whole life style. It is relatively easy to lose weight over a short period, but more difficult to maintain that weight loss over a longer term. Only improved sight, changed dietary habits, behavioural change and exercise will sustain optimal weight.

The Atkins diet: this is a high protein, low carbohydrate diet consisting of meat, cheese, etc, and avoiding starch, fruits, sugars and processed food.

Formula diet: this is a balanced diet. This formula to eat meals for which 40% of the calories are derived from carbohydrates, 30% derived from proteins and 30% from fats.

The hay diet: the hay diet is also known as ‘food combining for health’. It involves keeping starch foods separate from proteins in order to aid digestion.

Weight watchers pure points: each person attending weight-watchers weekly club session is privately weighed, and then there is a group discussion with the club leader to share news, hints and tips.

The pure point programme allots points rather than calories to a variety of food. Participants are allowed a predetermined number of points per day depending on how much they weigh and how much weight they need to lose. Most vegetables count zero points that means

they can eat as much as they like.they can save points from daily allowance to put towards a special food treat. They can add up points by doing exercises.

2. Physical activity

Specific recommendations for physical activity for people who are obese

a. Build up slowly towards 30 minutes of moderate-intensity activity a day. The 30 minutes can be accumulated throughout a day in 10 – 15 minutes bouts. Moderate intensity means breathing slightly harder than normal, but still within the comfort zone whereby the activity can be done whilst talking at the same time
b. To achieve optimal weight loss, consider extending some sessions to 45 minutes or longer, as this will encourage the use of fat as an energy source.
c. Increase the amount of daily routine activity such as gardening, shopping, house work , walking etc.,
d. Decreases the amount of time spent in sedentary activities, and tries not to sit down for more than 30 minutes at a time.

e. The most effective ativities for achieving weight loss are those that involve large muscle groups which are aerobic in nature, such as walking, swimming or cycling.

f. Consider weight-bearing exercises such as walking and climbing stairs, as these helps to conserve muscle mass and maintain strength and resting metabolic rate.

g. Find physical activities which are enjoyable.

3. Behavioral therapy

Any behavioral approach should take into account the fat that eating is a highly reinforcing behavior. It induce feelings of gratification and pleasure which for some people is their main source of pleasure, and such individuals will not forsake their eating for pleasure habit very readily.

The five stages of change include the following

1. Pre-contemplation
2. Contemplation
3. Preparation
4. Active change
5. Maintenance

Approaches to behavioral therapy are

1. Self monitoring

2. Stimulus control
3. Coping with cravings
4. Stress management
5. Relaxation techniques
6. Learn self control breaking the cycle between certain stimuli to eating particular foods and eating inappropriately
7. Problem solving skills
8. Mood management
9. Manage work and family
10. Relapse prevention
11. Avoiding self defeating thinking
12. Improving body image

4. Drug therapy

Most of the anti obesity drugs that have been used in the past have been withdrawn because they are ineffective or have adverse effects

Drugs should never be used as the sole element of treatment – other components of managed care should continue. Drug treatment should be discontinued if weight loss is less than 5 % after first 12 weeks, or if the patient gains weight at any time while he is receiving drug treatment.

Combination therapy involving more than one anti-obesity drug is contra indicated

Drugs used are

a.i. Binding agents – Chitosan

a.ii. Bulking agents – methyl cellulose, ispaghula husk

a.iii. Pancreatic lipase inhibitors – orlistat

a.iv. Centrally acting drugs – sibutramine, phentermine,fluoxetine

Unsuitable drugs for the treatment of obesity are

i. Diuretics

ii. Purgatives

iii. Hormone therapies

iv. Ephedrine

v. Amphetamines

5. Surgical(bariatric)

a. Restrictive procedures

i. Gastroplasty

ii. Laparoscopic gastric banding

b. Gastric bypass

c. Jejuno – ileal bypass

d. Surgery for super-obese persons – 80% distal gastrectomy and gastro ileostomy with diversion of biliary and pancreatic secretions to the distal ileum.
e. Liposuction
f. Jaw wiring procedures
g. Apronectomy
h. Artificial bezoars

PREVENTION:

Adopting Healthy Lifestyles

It is imperative to intervene early in childhood and adolescence to prevent and/or reverse the effects of overweight and poor eating habits. The home environment has a powerful influence on the health of a child. The parents have a unique opportunity to be a positive influence on their children's eating habits.

(*a*) *Healthy eating pattern:* Emphasis should be laid on nutrition rather than 'dieting'. Maintain healthy components of traditional diets such as fruits, vegetables and whole grain cereals and guard against energy dense, fatty, salty and sugary food.

(*b*) *Increased physical activity:* Dietary changes alone are often not enough to help a child lose weight. Taking part in exercise should be encouraged from an early age to promote self-esteem and help children function optimally, both physically and mentally. The enjoyment of sport at an early age, and the

influence of parents, friends, teachers, coaches and schools combine to shape lifelong attitudes and participation in sport and exercise. In general, moderate to vigorous activity for at least one hour a day may be a practical recommendation for all school going children.

(*c*) *Decreasing sedentary activities:* These activities lead to motion deprivation, and children spend hours doing little more than sitting down. These inactive and prolonged pastimes should be discouraged. Television viewing should be restricted to not more than one hour a day, and use of computers, telephone conversations should be reduced.

Interventions

Role of Schools: The schools should formulate and adhere to physical-education and activity requirements and standards. Schools should facilitate changes to increase physical activity and parent teacher associations can help to educate parents as to the dangers of childhood obesity. Schools should decrease consumption of unhealthy foods and beverages. Introduction of 'nutrition and physical education' in the school curriculum with these activities should become compulsory and /or a 'scoring subject' with marks to be added to total grades. The parents/students are then likely to give the required attention and time to these activities in this competitive world of academics.

Role of Family: Most experts agree that helping your child lose weight is a family affair. Everyone should be involved in planning meals, buying food and coming up with ways to be active together. Families should also make physical

activity a family priority and establish rules or guidelines that encourage activity and limit leisure time in front of the TV or computer. Changing your child's eating and exercise habits means changing your own as well. After all, you're in charge of what your child eats at home and how much exercise he gets when he gets home from school. Plus, you are a role model. If you exercise and eat healthy, your child shall follow suit.

Role of Government authorities: Programs having a bearing on the diet and lifestyle of children should be devised. Regulate fast food advertisements aimed at children and insist on food labeling. Departments can influence the food industry to reduce the levels of fat and sugar in foods targeted at children; and parent teacher associations can help to educate parents as to the dangers of childhood obesity. Schools encourage a responsible approach to marketing of these foods.

Role of Pediatricians : It is important for us to think of ‘prevention of obesity’ at all visits and incorporate relevant health education. BMI should be calculated and above 85th centile should be advised about lifestyle interventions while children with BMI >95th centile should be screened for co-morbidities. Encourage gradual weight control rather than crash dieting. The role of pharmaco-therapy is still unclear.

AIM

To assess the prevalence of overweight and obesity among school age adolescents (11-17 years) residing in north Chennai zone.

To assess the various factors influencing overweight and obesity.

To assess the influence of individual factors in the development of overweight and obesity.

MATERIALS AND METHODS

STUDY DESIGN:

It is a cross sectional and institutional study adopting multistage stratified cluster sampling procedure.

SAMPLE SIZE:

Considering the prevalence of obesity of 17 percent reported in earlier studies in 95 percent confidence interval with 20 percent relative precision in 1.2 design effect, the sample size arrived was 4700 to 4750. The formula used is $n = [(z_{\alpha/2} * \sigma)/ e]^{2.}$

SUBJECTS:

The subjects were adolescents in 11 to 17 years of age residing in zone 2 of north of Chennai, the capital city of Tamil nadu, the southern state of India. children from both sex randomized from random numbers generator.

PERIOD OF STUDY:

The study was conducted during the period of October 2007 to October 2008.

STUDY LOCALITY:

The study region includes north Chennai corporation zone II. It includes Royapuram including Washermenpet, Tondiarpet, and Basin Bridge including Korukkupet. The total number of high and higher secondary schools is 26.The numbers selected for sampling are 14.This includes government schools 5 and private and semi private 9.

INCLUSION CRITERIA:

School going adolescents of age 11 to 17 years during the study period residing in the study locality.

EXCLUSION CRITERIA:

- Children less than 11 years.
- Adolescents more than 17 years.
- The educational institutions catering to disabled children.

METHODOLOGY:

For the selection of schools, the list of all schools belonging to all categories (government, private, semi-private) was obtained from the school authorities of the local government. Generally government schools catered to poorer sections of the population. Whereas semi-private schools catered to lower middle and middle income groups. The children from upper middle and high income groups attend private schools. Probability proportionate to the size of the population (PPS) technique was used to decide the number of children to be studied from each school and then subsequently from each class and section. Fourteen institutions were selected. It was assumed that from each institution at

least 50 subjects would be recruited from each class. The students from all the sections of each class are listed in alphabetical order and using random number generator the students of required population (i.e., 50) were recruited for the study. A total of 4900 students were thus selected.

DATA COLLECTION:

The institutional ethical review board approved the study protocol. After obtaining consent from the heads of the educational institutions, the students were selected and oral assent from all the selected adolescents were obtained. A predesigned and pre tested questionnaire was used to interview the study population to elicit the information and family characteristics like residence, type of school, type of family, literacy status and occupation of father and mother and information on individual characteristics like age, sex, eating habits, mode of conveyance to school, time spent on television viewing and participation in games. The date of birth, socioeconomic status and residence were confirmed from school records. The literacy status of the parents, per capita income and the occupation of the parents were collected as proxy variables for the calculation socio economic status.

Information was also collected on physical activity, which included distance of school from the residence and the mode of transport used to go to school and physical activities such as participation in sports and games, aerobic physical exercises, frequency and duration of participation in household activities, time spent watching television and playing computer and video

games, perception of the body image, diet preferences, and consumption pattern.

MEASUREMENTS:

Trained investigators weighed all of the adolescents without shoes and heavy clothing with the subject standing motionless on the weighing scale with feet 15 cm apart with weight equally distributed on each leg with error margin of ± 100 grams. The weighing scale was regularly checked with known standard weights. A portable anthropometric rod was used for measuring height with an error to the nearest of 0.1 cm. The height was measured with subject standing in erect posture with the head positioned so that the top of the external auditory meatus was in the level of inferior margin of orbit. The international obesity task force references were used to define overweight and obesity in this study.

ANALYSIS OF DATA:

The data was analysed using SPSS. Adolescence were categorized into two groups, overweight(>=85th percentile) and non overweight(<85th percentile) using age and sex specific percentiles of BMI. Socioeconomic status is calculated based on modified Kuppusamy scale into lower (0-10), lower middle (11- 15), upper middle (16- 25) and upper (>25).

The occupation of the father are categorized into group 1 (service or business), group 2 (others). The literacy status of parents is grouped nas group 1(>= 10th standard) and group 2 (<10thstandard).the mode of conveyance to school is

categorized as group 1, those who come by bus, car or two wheeler and group 2, those by bi cycle and walking.

Physical activity were assessed by participation in household activities, indoor games, outdoor games and those involved n exercises like walking and jogging. Viewing television or playing video games were taken as marker of physical inactivity. Each variable was categorized based on hours of involvement per day/ week. The prevalence of overweight and obesity and 95% confidence interval were calculated according to age, sex, socioeconomic status, type of school and physical activity level. Association were assessed using χ^2 test. Multiple logistic regression was also carried out to examine association between independent variables and overweight and obesity. For all statistical test p value < 0.05 was taken as a significant level.

OBSERVATION AND RESULTS

Demographic profile of overweight and obesity on urban adolescents

Table 1

age	total	overweight	Obese
11	700	134(19.14)	29(4.14)
12	700	144(20.57)	30(4.29)
13	700	159(22.71)	28(4.00)
14	700	169(24.14)	28(4.00)
15	700	172(24.57)	30(4.29)
16	700	159(22.71)	28(4.00)
17	700	145(20.71)	27(3.86)
Total	4900	1082(22.08)	200(4.08)

Values in parentheses are percentages.

A total of 4900 adolescents in the age group of 11 – 17 years, with the mean age of 14 years, were studied.

Of these 1082 were overweight and 200 were obese. The overall prevalence of overweight (BMI >= 85th percentile) is 22.1% (95%CI: 21.2, 22.9). The prevalence of overweight among adolescents tends to increase at 14 – 15 years of life.

The overall prevalence of obesity (BMI >= 95th percentile) is 4.1% (95%CI: 3.9, 4.3)

Sex distribution

Table 2

	total	overweight	Obese
Total	4900	1082	200
Male	2317(47.3)	465(20.1)	88(3.8)
Female	2583(52.7)	617(23.9)	112(4.3)

Values in parentheses are percentages

Approximately 47% were boys and 53 % were girls. The proportion of overweight was higher among girls (23.9%; 95% CI: 22.9, 24.9) than among boys(20.1%;95%CI:19.4,20.8) and the difference found was statistically significant($p < 0.05$). regarding obesity the difference is same as of overweight.

Table 3
Overweight trend in boys

age	total	overweigh t	%	obese	%
11	330	60	18.2	13	3.9
12	340	69	20.3	13	3.8
13	318	71	22.3	13	4.1
14	320	75	23.5	12	3.8
15	338	71	21	12	3.6
16	326	63	19.3	12	3.7
17	345	56	16.2	13	3.8
Total	2317	465	20.12	88	3.81

Table 4
Overweight in girls

age	total	overweight	%	obese	%
11	370	74	20	16	4.3
12	360	75	20.8	17	4.7
13	382	88	23.1	15	3.9
14	380	94	24.7	16	4.2
15	362	101	27.9	18	5
16	374	96	25.7	16	4.3
17	355	89	25.1	14	3.9
Total	2583	617	23.9	112	4.33

The prevalance of overweight among boys tends to rise gradually with highest at the age of 14 years (23.5) and decreased to 16.2% at the age 17 years. Whereas in girls the peak is at the age of 15 years (27.9) and decreased to 25.1 at 17 years of age.

ASSOCIATION WITH SOCIO ECONOMIC FACTORS

Table 5

Class	total	overweight	obese
Lower	1141	53(4.6)	10(0.9)
Lower middle	1665	242(14.5)	42(2.5)
Upper middle	1265	328(25.9)	60(4.7)
upper	829	459(55.4)	88(10.6)

Values in parentheses are percentages

23% of sample belongs to lower socio-economic class and lower middle, upper middle and upper is represented by 40, 26, 17 % respectively. It is significantly higher among adolescents of higher socio economic status(55.5%) compared to those with lower socio economic status(4.6%).

Table 6

occupation	total	overweight	Obese
Service/ business	3528	907(25.7)	163(4.6)
others	1372	175(12.8)	37(2.7)

Values in parentheses are percentages

The major occupation of fathers were either service/business or the others forms. We have found that the prevalence of overweight was higher among adolescences whose parents' occupation was service or business than others.

Table 7

Type of school	total	overweight	Obese
Government	1750	365(20.9)	60(3.4)
private	3150	717(22.8)	140(4.4)

Values in parentheses are percentages

Of the 14 schools sampled, 5 belongs to government sector and 9 from private and semi-private groups. Generally adolescence from government schools cater from lower socio economic status, whereas middle class caters semi private schools and upper class represents private schools. The prevalence of overweight among the adolescence studying in private including semi private is significantly higher among those in government schools.

Table 8

literacy	total	overweight	Obese
<10	2232	684(30.6)	173(7.8)
>=10	2668	398(14.9)	27(1.0)

Values in parentheses are percentages

Regarding literacy status of parents, those adolescents whose parents have studied 10^{th} standard and above were found to be less overweight

EATING HABITS

Table 9

Junk foods	total	overweight	Obese
Like	2940	807(27.4)	165(5.6)
dislike	1960	275(14.0)	35(1.8)

Values in parentheses are percentages

Approximately 60% of adolescents preferred to consume junk food because they are their favorite dishes. 807 children of those who consume junk food were overweight, with the prevalence being 27.4%. Among those who don't consume junk food 275 were overweight. The prevalence found in this variable is statistically significant.

MODE OF CONVEYANCE

Table 10

Mode of conveyance	total	overweight	Obese
Group –I	3143	974(31.0)	188(6.0)
Group - II	1757	108(6.1)	12(0.7)

Values in parentheses are percentages

The prevalence of overweight among group – I (those come by car, bus, and motorcycle) was significantly higher than those among group – II (by bicycle and walking).

ROLE OF PHYSICAL ACTIVITY

Table 11

level of physical activity					
detail	total	overweight	%	obese	%
house hold activities					
none	884	436	49.3	87	9.8
<3/d	937	219	23.4	43	4.6
>3/d	3079	427	13.9	70	2.3
outdoor games					
None	2010	776	38.6	137	6.8
<6/wk	1012	169	16.7	31	3.1
>6/wk	1878	137	7.3	32	1.7
indoor games					
None	2386	804	33.7	141	5.9
<6/wk	1242	190	15.3	34	2.7
>6/wk	1272	88	6.9	26	2.0
walking					
None	3600	922	25.6	173	4.8
<3/d	1012	160	15.8	27	2.7
>3/d	288	0	0.0	0	0.0
jogging					
None	4090	998	24.4	184	4.5
<3/d	528	84	15.9	16	3.0
>3/d	282	0	0.0	0	0.0
tv					
None	46	1	2.2	0	0.0
<3/d	892	70	7.8	29	3.3
>3/d	3962	1010	25.5	170	4.3

About two third of adolescents participating in house hold chores whereas 99 % reported watching television on school days. About two- fifth of adolescents did not participate in outdoor games whereas 38% were participating in outdoor games more than 6 hours per week. The prevalence of overweight was significantly lower among the adolescents who participated in

outdoor games than those who not participated ($p<0.004$). It was also significantly higher among the adolescents who did not perform any household chores. Similarly, overweight and obesity was significantly higher in who were not involved in physical activities like walking, cycling and jogging. The prevalence of overweight among adolescents who were sedentary, watching television more than three hours per day was also significantly higher compared to those who watch 0 or less than 3 hours.

To adjust for potentially confounding variables and to study possible mediating factors, a multivariate logistic regression analysis was carried out. In the model, although overweight and obesity were dependent variables , age, sex, occupation, socioeconomic and educational status of parents, physical activity such as participation in sports, games, household activities, aerobic exercises, likes and dislikes of junk foods, and physical inactivity such as watching television, and playing computers/ video games formed independent variables. This analysis revealed that the risk of overweight was 10 times higher among adolescents of high socioeconomic status , 2.3 times higher among who were participating in <6 hours per week in outdoor games, 3.8 times higher among those who were not participating in household activities, 9 times higher among those who were watching television more than three hours per day.

DISCUSSION

This is a comprehensive study attempting to document the prevalence of overweight and obesity and their associated factors that covered an adequate sample of urban adolescents. The overall prevalence of overweight (>= 85th percentile of BMI) among the urban adolescents studied was 10 times higher than that of their rural counterparts reported by the national nutrition monitoring bureau surveys in 2002(33). In our study, the prevalence was higher when compared to the studies carried put in Ludhiana, Pune, Maharashtra. This may be due to the age group taken in the study as they studied in 10 – 15 years whereas our study included up to 17 years. The prevalence was also seem to be increasing in our city as the previous studies shows about 17 % were obese in the year 2002 studied by Ramachandran et al group in Chennai. The prevalence was lower when compared to Delhi studies where they found 26% overweight. (25) This is due to the fact that their studies have selected subjects from affluent societies. In Delhi study, the sample was taken from one school only.

A clear socioeconomic gradient was observed in this study, which is consistent with other studies.(35,36) This could be for several reasons that are related to obesity, encountered to a greater extent in higher socioeconomic groups. Studies have reported arise in sedentary behaviors such as increased use of vehicular transport and decreased use physical activity has led to increased prevalence of overweight and obesity.

The prevalence was significantly higher in the female in our study where as it is only marginally higher in other studies. It can be due to more number of female samples in our study.

Overweight and obesity is marginally higher in the pubertal age group, i.e., 13 – 15 years, as we observed in other studies in Delhi and Chennai, perhaps because of increase in adipose tissue and overall body weight in children during puberty. The prevalence was marginally lower in the post pubertal age group. It has been reported that the number of fat cells increases during periods of rapid growth up to 16 years after which fat ordinarily accumulates by increasing size of fat cells already present.(37)

The results clearly revealed that regular physical activity was an important factor in reducing prevalence of overweight and obesity. The prevalence was significantly lower in the children who participated regularly in household chores ($p < 0.001$), played outdoor games, and performed physical exercise. The diets of the children in the higher socioeconomic group are known for their higher fat content, and the subjects are involved in more sedentary activities. These observations are consistent with results of previous studies (39). In addition, the prevalence of overweight and obesity were higher among children who were involved in sedentary activities such as spending 3 h/d on television viewing (31). Klesges et al. (39) also reported the effect of watching television on metabolic rate and overweight and obesity in children. In urban areas, considering the safety of keeping children away from heavy traffic,

parents feel more comfortable if their children play indoor games or watch television and, therefore, do not encourage them to participate in outdoor sports and games.

Approximately 7.9% adolescents felt that they were either overweight or obese where as 70 % felt that they are of normal weight. More over there is a need to educate them about obesity and its co-morbidities and it should be included in their subjects.

Freedman et al. (23) showed the adverse effects of overweight in their 17-year follow-up study and reported that an early average increase of 0.5 kg/m^2 of BMI in children increases the risk for hypertension, dyslipidemia, and type 2 diabetes a decade later. It is interesting to note that 8% of adolescents perceived that they were overweight, which indicates that the self-reporting of obesity could also be a good indicator of the problem.

The major conclusion drawn from this study is that low levels of physical activity, watching television, and consuming junk foods are associated with a higher prevalence of overweight. Thus, participation in household activities and regular physical exercise could help in lowering the prevalence of overweight. Therefore, the role of physical activity, games, and sports should be emphasized, and facilities should be provided for outdoor games in schools, with compulsory hours of sports and games. There is an urgent need to educate the urban community on the aspects of healthy food habits and desired lifestyles to prevent overweight/obesity and its associated ill effects.

RECOMMENDATIONS

1. There is an urgent need to tackle this burgeoning problems regarding prevalence of overweight and obesity
2. The child who is overweight in his/her adolescence will carry over it into adult hood They are at the major risk of co morbidities when they were obese from childhood
3. Food preferences set earlier is likely to be carried out into adult hood so need to educate in the adolescents as they for the future society and the role models for their off springs.
4. So they intervention studies have to be planned to educate the society from the adolescent period.
5. Nutrition should be a part of their syllabus and helps in adopting healthy nutritional practices.
6. Parents are the role model for their children, educating them about healthy life styles is crucial in the prevention of obesity in children.
7. The best way of treating obesity is by preventing it as the treatment aspects are difficult and shows little effects

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AGE GROUP DISTRIBUTION

CHART 1

SEX DISTRIBUTION

CHART 2

CHART 3

AGE DISTRIBUTION BOYS

CHART 4
AGE DISTRIBUTION IN GIRLS

CHART 5

SOCIOECONOMIC PROFILE

CHART 6
SCHOOL TYPE

CHART 7
OCCUPATION

CHART 8

JUNK FOODS
CHART 9

MODE OF CONVEYANCE

CHART 10

LEVEL OF PHYSICAL ACTIVITY - OVERWEIGHT

CHART 11PROFORMA

Name Of The Child:
Age: D.O.Birth: Sex:
Locality:
Family Details
Type Of Family: Nuclear / Joint
Occupation Father: Mother:
Literacy Father: Mother:
No Of Children: 1 / 2/ >2
Income :
School Type : Government / Private
Eating Habits: Junk Foods Like / Dislike
Type Of Junk Food Consumed:
Mode Of Conveyance To School
Group – I - Car/ Bus/ Motorcycle
Group – II – Bicycle/ Walking
Physical Activity
Participation In Household Activities : Yes/No If Yes Duration:
Participation In Outdoor Games : Yes/No If Yes Duration:
Participation In Indoor Games : Yes/No If Yes Duration:
Participation In Walking : Yes/No If Yes Duration:
Participation In Jogging : Yes/No If Yes Duration:
Watching : Yes/No If Yes Duration:
Anthropometric Measures:
Body Weight: Height:
BMI: